Title: Flexibility, Fact or Fiction?

Brief Overview:

In this unit students will work in cooperative groups measuring personal flexibility of their body. They will record, display, analyze, predict, and present their own data.

Links to NCTM Standards:

- **Mathematics as Problem Solving**
  Students will solve mathematical problems in a cooperative group setting.

- **Mathematics as Communication**
  Students will demonstrate their ability to communicate mathematically by completing a writing prompt, giving an oral presentation, and summarizing conclusions in a written format.

- **Mathematics as Reasoning**
  Students will support their conclusions utilizing data collected.

- **Mathematical Connections**
  Students will demonstrate comprehension the range of motion in the human body.

- **Number and Number Relationships**
  Students will demonstrate their ability to compare and use percentage and angles to find the range of motion.

- **Number Systems and Number Theory**
  Students will demonstrate their ability to measure angles.

- **Computation and Estimation**
  Students will demonstrate their ability to calculate percents.

- **Statistics**
  Students will demonstrate their ability to collect,organize, display and interpret data for range of motion.

- **Measurement**
  Students will measure angles using different body movements.

Links to Life Science Standards:

- **Understanding of Scientific Inquiry.**
  Students will demonstrate the ability to collect data for the measurement of muscle flexibility.

- **Structure and Function in Living Systems**
  Students will demonstrate understanding of the flexibility and range of motion of human body by participating in a classroom lab exercise.

Grade/Level:

Grades 6-8

Duration/Length:

This investigation will take 3-4 days.

Prerequisite Knowledge:

Students should have working knowledge of the following skills:

- Knowledge of muscular system
- Measuring angles
- Collect/analyze data and create graphs using data
- Calculate and compare percents

Objectives:

Students will:

- collect and analyze data.
- calculate percents.
- construct appropriate graphs.
- predict angle of motion for body part.
- identify angle of motion for body part.
- compare angle of motion with other students and draw conclusions.
- convert angle of motion into percentage.
- construct graph to compare students' percentage of flexibility.
- compare estimation and actual values.

Materials/Resources/Printed Materials:

- Protractor
- Meter stick
- Colored pencils /water-based markers
- Large paper / newsprint

Optional:
- Graphing calculator
- CBL (Computer-based Laboratory)

Development/Procedures:

Day 1:

Suggest students wear appropriate dress to be able to move freely. Present unit to students. Clarify the Lab procedures and answer any questions that the students may have.

Complete KWL chart, What you know about arm/leg flexibility, What you need to know, What you have learned chart.

Complete Activity Sheet I.

Day 2:

Review lab procedures.
Complete Activity Sheet II.

Day 3:

Group discussion of results.
Complete lab summary.

Day 4:

Brief five minute group presentations.

Performance Assessment:

The assessment for this unit is the rubric for Activity I, Activity II, Lab Summary, and Oral Presentation.

Extension/Follow Up:

- Assimilate class data and compare as a larger group. Determine who is the most and least flexible.
- Explore athletic versus non-athletic persons with flexibility.
- Is flexibility inherited? Explore parental and sibling flexibility with a home investigation. Compare results.
- Explore how age differences affect flexibility.
- Explore using the Internet career possibilities that would involve flexibility and range of motion.
- Using the Internet, gather information about branches of athletics, famous athletics, and flexibility.
- If available, a graphing calculator and CBL unit can be used to record and produce graphs.

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Rubric: Activity I and Activity II

3 Lab completely correct. Summary is supported by data.

2 Four out of the six aspects of the lab are completed correctly. Data may be slightly incomplete. Calculations may contain a few errors. Summary is complete.

1 Two out of the six aspects of the lab are completed correctly. Data is incomplete, Calculations may be incorrect. Summary is slightly incomplete.

0 Lab is incomplete, or not completed at all. No summary.

Rubric: Lab Summary

3 Twelve out of twelve questions are answered completely. Summary is in paragraph form and supported by data.

2 Eight out of twelve questions are completed correctly. Summary is in paragraph form.

1 Six out of twelve questions completed correctly. Partial summary.

0 No questions or summary completed

Rubric: Oral Presentation

2 A three to five minute presentation of data and analysis. Clear, audible, and presented with eye contact. Presentation is in a logical sequence. Participation by all group members.

1 A one to three minute presentation of data. Clear, audible, and presented in a logical sequence.

0 No oral presentation.

Procedures: Activity I

1. Use a different color pencil to represent the data for each team member. Estimate angle of flexibility of resting and warm leg. Record on Activity Sheet I.

2. Use masking tape to attach 5 ft. sheet of paper to flat wall. Draw vertical line with ruler down left edge of paper (12 in.). Repeat with right edge. This is the starting point.

3. Stand with your back against the wall in front of the large sheet of paper.

4. Stand with legs astride. A team member will trace with colored pencil the outside of left leg of student standing astride. Student raise left leg to the side. **NEVER FORCE YOUR LEG FARTHER THAN IT CAN BE COMFORTABLY RAISED.**

5. A team member will trace the top of the raised leg with colored pencil.

6. Student moves away from sheet of paper attached to wall. Use meter stick to extend lines until the lines form an intersection at an angle.

7. Use protractor to measure angle of motion for the leg. (Resting)

8. Record data on Activity Sheet I.

9. Repeat steps 3 through 8 with right leg. (Resting)

10. To warm up your leg, exercise leg by raising a straight leg back and forth 12 times and then immediately test.

11. Calculate percentage of flexibility by using this formula.

$$\frac{\text{angle of leg}}{180 \text{ degrees}} \times 100 = \% \text{ of flexibility}$$

12. Graph percent flexibility of Resting and Warm Leg. (Hint: Double-bar) Label headings and title.

Procedures: Activity II

1. Use a different color pencil to represent the data for each team member. Estimate angle of flexibility of resting and warm arm. Record on Activity Sheet II.

2. Use masking tape to attach 5 ft. sheet of paper to flat wall. Draw vertical line with ruler down left edge of paper (12 in.). Repeat with right edge. This is the starting point.

3. Stand with your left shoulder touching the wall in front of the large sheet of paper.

4. Raise arm over head past your ear as far back as comfortable. A team member will trace with colored pencil the outside of left arm of student standing in front of paper. Then lower arm and move pass hip. Extend arm as far as possible behind you. **NEVER FORCE YOUR ARM FARTHER THAN IT CAN BE COMFORTABLY RAISED.**

5. A team member will trace the top of the raised arm with colored pencil.

6. Student moves away from sheet of paper attached to wall. Use meter stick to extend lines until the lines form an intersection at an angle.

7. Use protractor to determine the angle of motion of the arm, which is the larger angle. (Resting)

8. Record data on Activity Sheet II.

9. Repeat steps 3 through 8 with right arm. (Resting)

10. To warm up your arm, exercise by performing 12 arm circles, and then immediately test.

11. Calculate percent of flexibility of arm by using this formula.

$$\frac{\text{angle of arm}}{360 \text{ degree}} \times 100 = \% \text{ of flexibility}$$

12. Graph percent flexibility of Resting and Warm Arm. (Hint: Double-bar) Label headings and title.

Lab Summary

Analysis of Data

1. Which body part has the greatest degree of flexibility?
2. Which body part has the less degree of flexibility?
3. Which motion of body part was most difficult to perform?
4. Is there a difference in flexibility on right side of the body compared to left side of body?

Conclusion

1. Compare flexibility of the left and right side of the body.
2. Does warming up improve flexibility?
3. Compare your estimation with your actual data for flexibility. Quote data in Activity Sheets.
4. Compare the flexibility of other students with your flexibility. Quote data in Activity Sheets.
5. Does height of student affect flexibility?
6. Does sex of student affect flexibility?

Writing Prompt

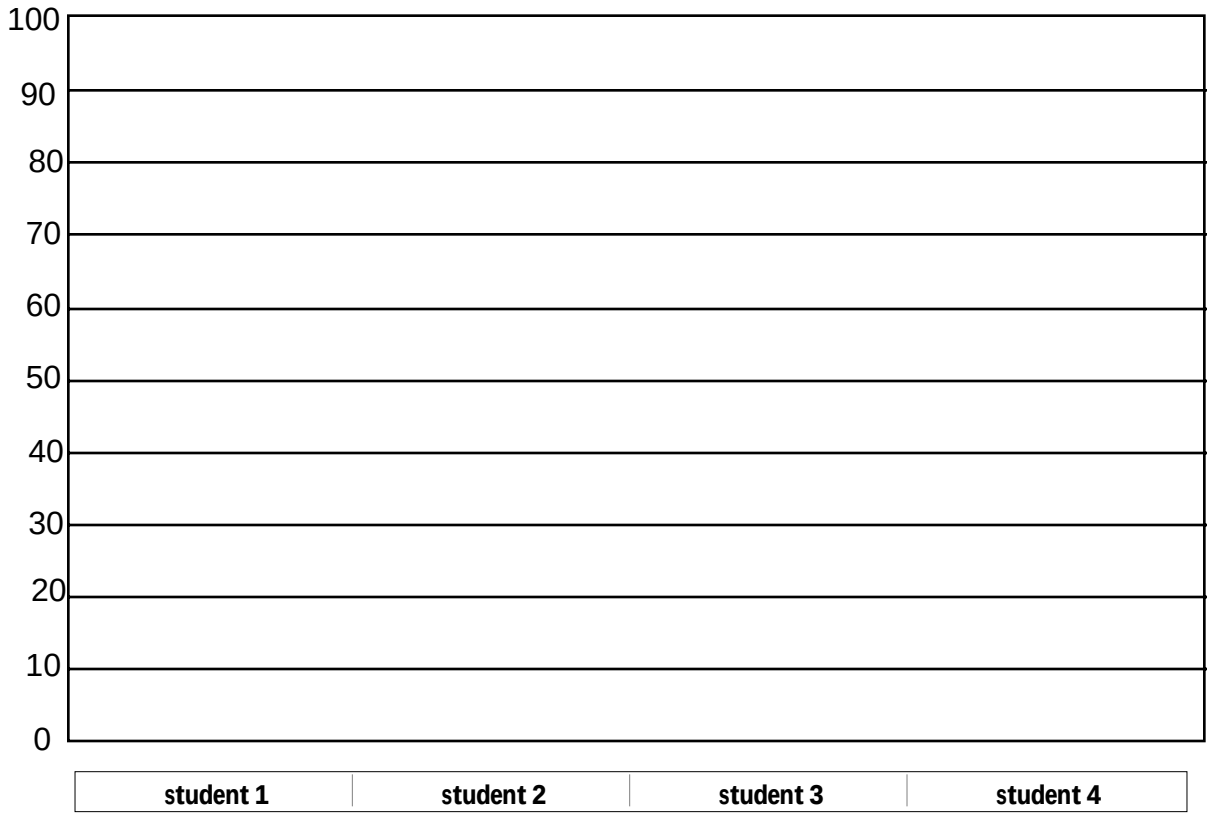
Write a paragraph summarizing your findings. Remember to support your answers. Complete KWL chart.

KWL CHART

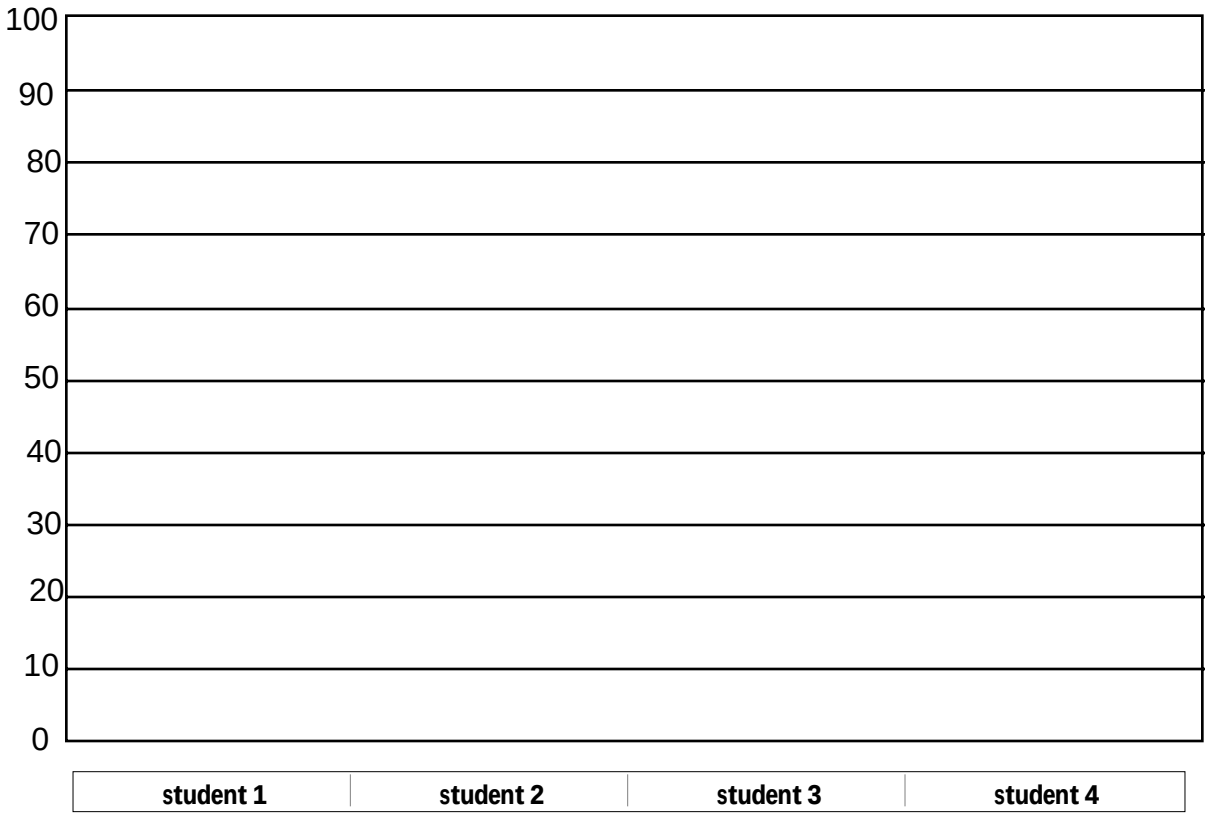
What I ...

Know	Want to Know	Learned

GRAPH I _____


100
90
80
70
60
50
40
30
20
10
0
student 1
student 2
student 3
student 4

GRAPH II _____


100
90
80
70
60
50
40
30
20
10
0
student 1
student 2
student 3
student 4

Activity Sheet I

Name:_____ Date:_____

Student	Est. of Angle Flexibility		Resting Leg		Warm Leg		% Flexibility		Remarks
	Resting	Warm	Left	Right	Left	Right	Resting	Warm	

Show math calculations for percent of personal flexibility.

Please Complete the following.

From this investigation I discovered :

_____

_____

_____

_____

_____

Activity Sheet II

Name:_____ Date:_____

Student	Est. of Angle Flexibility		Resting Arm		Warm Arm		% Flexibility		Remarks
	Resting	Warm	Left	Right	Left	Right	Resting	Warm	

Show math calculations for percent of personal flexibility.

Please Complete the following.

From this investigation I discovered :

_____

_____

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_____

_____